Against the Grain

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Collecting to the Core: Evolution for Everyone

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Collecting to the Core — Evolution for Everyone

by **Louise F. Deis** (Science and Technology Reference Librarian, Lewis Science Library, Princeton University; General Science Editor, *Resources for College Libraries*) <lfdeis@princeton.edu>

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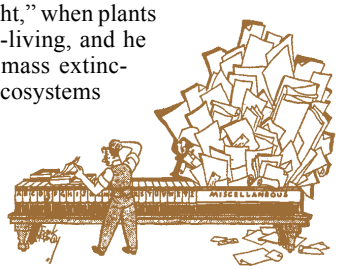
Column Editor's Note: *The "Collecting to the Core" column highlights monographic works that are essential to the academic library within a particular discipline, inspired by the* ***Resources for College Libraries*** *bibliography (online at* ***http://www.rclweb.net****). In each essay, subject specialists introduce and explain the classic titles and topics that continue to remain relevant to the undergraduate curriculum and library collection. Disciplinary trends may shift, but some classics never go out of style. — **AD***

Evolution is fascinating subject matter for specialist researchers as well as the general reader. Tracing a universe set in motion by a "big bang" 13.8 billion years ago, science scholarship has shown that evolutionary change is never-ending. We have learned that life emerged from stardust and under "just so" conditions single living cells arose. Throughout its 4.5-billion-year existence, Earth has been shaped by cataclysmic as well as infinitesimal change, and the life forms that began approximately 3.5 billion years ago have adapted to — or perished from — the many different conditions and circumstances. Recent decades have brought new discoveries from the field by paleontologists and biologists and in the laboratory by molecular biologists and geneticists. This essay discusses evolution books (largely specific to animals) aimed primarily at the general public or nonscience student. Any single one of these titles offers an accessible background to evolutionary science; as a whole, they provide a small collection of contemporary general works for anyone interested in evolution and the history of life on Earth.

Georges-Louis Leclerc, **Comte de Buffon**, natural historian of wide-ranging interests, conceived of the ideas of geological history and paleontology in the mid-eighteenth century, preceding those with much more familiar names in the foundation of evolutionary theory: **Charles Darwin**, **Alfred Russel Wallace**, **Jean-Baptiste Lamarck**. Additional credit belongs to **George Gaylord Simpson**, **Alfred Romer**, and **Lynn Margulis** for testing and transforming evolutionary theory into proven fact. **John Maynard Smith** deserves recognition as having written one of the twentieth century's seminal works in the field, *The Theory of Evolution*, first published by **Penguin** in 1958 with a 1993 canto edition from **Cambridge University Press** featuring a foreword by **Richard Dawkins**.[1] Whereas **Maynard Smith's** work is perhaps the most dense cited here (though quite comprehensible for the general reader), the most beautiful book in this list is easily evolutionary biologist **Douglas Palmer's** *Evolution: The Story of Life*.[2] It definitely qualifies for the coffee table, as it is filled with illustrations providing wonderful tableaus of prehistoric periods derived from "100 of the finest fossil sites from around the world." Characteristic species are drawn, named, and placed in time and space, all in full color. **Palmer** includes a gazetteer of sites, an index to species, a taxonomic listing of species, and a section depicting relationships (cladistics) among animals based on fossil and biochemical similarities. By contrast, paleontologist **Michael Benton** has written *The History of Life*, which you can stick in your pocket, though it is also available online as part of **Oxford's** "Very Short Introduction Series."[3] It is eminently readable, with 20 key photos, charts, and illustrations. His chapters include origins of life, sex, skeletons, and life on land. He devotes a chapter to "Forests and Flight," when plants and animals adapted to land-living, and he discusses the end-**Permian** mass extinction and origins of modern ecosystems and humans.



The lasting legacy of **Charles Darwin** reverberates through nearly all present-day work on evolution. Modern scientists not only build on **Darwin's** hypotheses and observations, they use his lyrical language. One of the most recent to do so is author **Carl Zimmer**, an award-winning and reliable source for eloquent popular science writing. His 2014 *The Tangled Bank: An Introduction to Evolution* is a valuable textbook whose title alludes to **Darwin's** poetic imagery, from the concluding pages of the *Origin of Species*, of an "entangled bank" teeming with interdependent life forms.[4] **Zimmer** briefly defines evolution as "descent with modification" and sets out his agenda with the statement, "Understanding evolution is too important to be limited only to evolutionary biologists." He begins with "Walking Whales," showing that some forms of life returned to the water; additional chapters cover geology and paleontology, the biological tree of life, how change can occur, molecular evolution, adaptation, sex, origins, and macroevolution. The final three chapters deal with the evolution of humans and behavior, as well as evolutionary medicine. Each chapter has a generous bibliography pointing readers to further research and nearly every page features a color photo, illustration, chart, or graph.

If pictures appeal, certainly *Fossils: The History of Life* by **Richard Fortey**, former senior paleontologist at London's **Natural History Museum**, deserves inclusion. Now in its fourth edition, this volume illustrates life over time with beautiful, colorful fossil photos and illustrations, and **Fortey** has won much recognition for his ability to explain science to the public.[5] One would be completely edified and entertained by reading any of the following books by evolutionary biologist **Sean B. Carroll**: *The Making of the Fittest, Endless Forms Most Beautiful,* or *Remarkable Creatures*.[6-8] His ability to communicate abstruse concepts and clearly illustrate scientific stories makes him one of the current preeminent authors writing scientific research with mass appeal. The chapters of *Fittest* begin with captivating stories from great moments of scientific history, including the first use of DNA analysis, the discoveries of the icefish and the coelacanth, and the tale of **Trofim Lysenko's** pseudoscience. In *Remarkable Creatures* **Carroll** presents a compilation of biographies of famous naturalists and scientists who have made remarkable discoveries, often under great hardships, in natural history, fossils, or species. He features the groundbreaking work from thinkers like **Alexander von Humboldt**, **Charles Darwin**, **Alfred Russel Wallace**, and **Henry Walter Bates**, then moves into the modern molecular basis for evolution with stories about **Linus Pauling**, **Emile Zuckerkandl**, **Allan Wilson**, **Vincent Sarich**, **Mark Stoneking**, and **Svante Pääbo**.

Any list discussing monographs on evolution should also include work by the influential paleontologist and evolutionary biologist **Stephen Jay Gould**. Of his many works, *Wonderful Life* is included here because of its discussion of the **Burgess Shale Formation** found in the **Canadian Rockies**.[9] These are fascinating fossils of many different soft-bodied fauna that appear to have no descendants, an example of "chance" evolution. In this book **Gould** also echoes **Darwin's** ideas regarding the testability of evolution — its unpredictability and contingent nature — by explaining theories via "embryology, biogeography, the fossil record, vestigial organs, and taxonomic relationships."[10] **Andrew Knoll** (Professor of Natural History and Professor of Earth and Planetary Sciences at **Harvard University**) deserves inclusion also for his scholarly yet lucid book *Life on a Young Planet*: *The First Three Billion Years of Evolution on Earth*.[11] He writes picturesquely, even though the book does not contain many pictures or illustrations, and the epilogue is particularly eloquent. This book includes a lengthy section for further reading. Paleontologist **Neil Shubin** is Professor of Anatomy

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at the **University of Chicago** and was part of a team to discover a missing link in the evolution of creatures from sea to land, *Tiktaalik roseae.* His *Your Inner Fish: A Journey into the 3.5 Billion Year History of the Human Body* traces aspects of human development from the first vertebrates, following the phylogeny (development over generations of related species) of teleost fishes to human anatomy: arms and hands, teeth, breathing apparatus, olfaction, hearing, and vision.[12] This monograph is a best seller which has also been adapted into a **PBS** television series, and represents well how approachable scientific research can be for the general population.

Titles explaining evolution also often directly confront the sector of skeptics who doubt evolutionary science. Two publications released in 2009 (also the 150th anniversary of the original publication of **Darwin's** *The Origin of the Species*) attempt to cement evolution as a scientific certainty. **Richard Dawkins** is a well-known scientist (and secularist) who makes a very solid case for the "inescapable fact" of evolution in *The Greatest Show on Earth*: *The Evidence for Evolution*.[13] The evidence presented is not only observational and empirical, but has been experimentally recreated in the lab as well. **Jerry Coyne**, a professor in ecology and evolutionary biology at the **University of Chicago**, wrote *Why Evolution Is True*.[14] He defines evolution and explains how we can tell the age of fossils by what is "Written in the Rocks." **Coyne** discusses embryonic development and dead ends, with chapters on sexual selection and human evolution. Throughout, the writing is clear, insightful, and well documented. *The Fact of Evolution*, by anthropologist **Cameron Smith**, plainly explains biological replication, variation, selection, speciation, and evolution.[15] He recounts evidences of evolution in action with examples from insects, crustaceans, birds, fish, mammals, viruses, and other microbes. There are figures and tables, extensive notes and indexes, and a healthy bibliography and webliography.

Scientific discourse naturally contains a long history of contrasting and culturally charged viewpoints (see eighteenth-century French paleontologist **George Cuvier** and his then-radical ideas on extinction); other authors attempt to integrate the possibility that religious belief is compatible with evolutionary truth. **Nobel Prize** winner and biochemist **Christian de Duve** has written a few books that approach evolutionary science with an element of spiritual grace. *Life Evolving*: *Molecules, Mind, and Meaning* explores the chemical molecules that make up life, the origin of cells, multicellularity, and beyond.[16] Raised Catholic, **de Duve** writes eloquently about the differences between science and religion. His later book, *Genetics of Original Sin: The Impact of Natural Selection on the Future of Humanity*, is outstanding, but rather despairing of humanity's destructiveness.[17] **Simon Conway Morris**, a paleobiologist, takes the position that evolution is more patterned and directed than random. He has written at least one monograph defending this stance, *Life's Solution: Inevitable Humans in a Lonely Universe*, as well as chapters for compilations on science and religion.[18] An excellent book on evolution and the origin of life is *How Life Began: Evolution's Three Geneses*, by French marine biologist **Alexandre Meinesz** (translated by **Daniel Simberloff**).[19] It concentrates on three "geneses" of life — bacteria, nucleated cells, and multicellular organisms — showcasing how evolutionary events like natural selection, recombination, mutation, and geologic cataclysm create biodiversity and a "grandeur of life."

In a topic as historic, wondrous, universal, and ever-changing as evolution, it can be challenging to limit titles to a brief bibliography such as this. Many of the selections herein exist at a fine intersection to be profitably, and enjoyably, read by both the amateur and professional. These monographs not only complement the undergraduate library collection in the sciences; they offer entry for everyone into the never-ending story of evolutionary life on Earth.

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